

AO CONNECTIONS

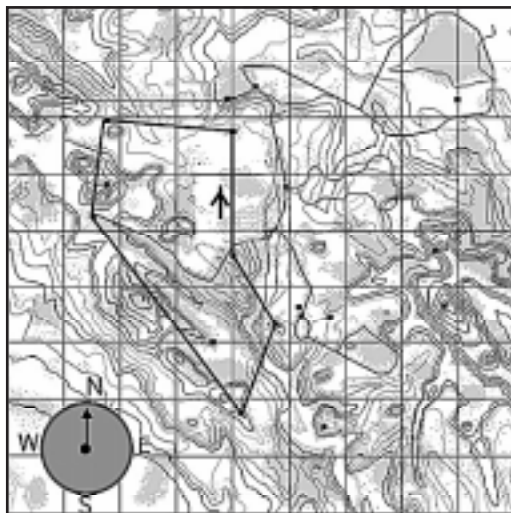
June 13, 1997

Information for the NASA Ames Aeronautical Test & Simulation Community



TTCP2 VMS Simulation

by Joe DeMaio and Luong Nguyen



This moving map shows the topology of the terrain flown during the test simulation. The aircraft is on one possible flight path, between waypoints (represented by squares.)

The Technical Coordination Panel (TTCP2) simulation was conducted in the VMS from March 3rd to March 28, 1997, with eight pilots and 132 data runs. This simulation is part of the Army's overall research program. The primary objective of this test is to compare various techniques of alerting the pilot and drawing the pilot's attention away from the Helmet Mounted Display (HMD) into the cockpit. A second part of the test involved navigating with helmet-integrated navigational tools to supplement moving maps on the cockpit console.

Previous alarms have been presented on the cockpit instrument panel, but future aircraft design will display alarms on the HMD. This particular investigation compares a localized alarm, consisting of one flashing HMD symbol (focal alert), to a full-screen alarm, in which all symbols on the display flash (ambient alert). These two conditions were tested in three situations:

1. Pilot is doing nothing but waiting for an alarm
2. Pilot is flying and receives an alarm every twenty or thirty seconds

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Modernization of the Ames Unitary

Plan Wind Tunnel

by Frank Kmak

The Unitary Plan Wind Tunnel (UPWT) at NASA/Ames is being modernized and refurbished. The UPWT consists of three tunnel legs and an Auxiliaries facility. The three legs are the 11-by 11-foot Transonic leg, the 9-by 7-foot Supersonic leg, and the 8-by 7-foot Supersonic leg. Planning for the modifications began in 1988, with the first construction beginning 1993. There were sixteen 'bid packages' or work units contracted out, most of which are finished.

From the potential customer's point of view, the changes to the UPWT

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Ames Aero Days!



Bring your kids to try out the new Aeronautics CD! (Be sure to share the mouse!)

See back page



Modernization of the Ames Unitary Plan Wind Tunnel

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will result in:

- Improved productivity due to automation
- Better test section flow quality
- Larger, 'user friendly' control rooms
- Improved performance and capability
- Increased reliability of the overall facility

The work that has been done in this eighty million dollar project will keep the UPWT facility at a world-class level for years to come, and allow NASA to continue to serve the needs of the aerospace community.

Automation

The old control consoles consisted of pistol grips, buttons and gages for facility operation. All the old instrumentation and control system wiring are replaced, and new control consoles will be installed in the three wind tunnel control rooms, and the Auxiliaries control room. Over 3000 sensors and actuators have been installed. Automation of tunnel operations will allow test operators to input a series of test conditions and model angle schedules into a table prior to a data run series. The process of moving the model through the tunnel conditions while taking data at each point will be fully automated. A completely new hardwired safety system is in place.

At this time the automation part of the project is still in process. The automation hardware has been installed in the 11-by 11-foot tunnel and the Auxiliary facility, and the accompanying software will be site-tested soon. The 9-by 7-foot and 8-by 7-foot tunnel software is still in development.



Flow Quality

The objective of the flow quality improvements is to reduce the turbulence, flow angularity and low frequency Mach number fluctuations in the test section of the 11-by 11-foot leg. The new Turbulence Reduction System (TRS) consists of a honeycomb and two 6-mesh screens that have been installed in the settling chamber of the tunnel. To improve flow in the Wide Angle Diffuser (WAD) region, a turning vane structure and flow deflector flaps have been installed. Scale-model and full-scale characterization tests were done to validate the effectiveness of the new vane and flap design in reducing the low-frequency fluctuations and improving diffuser flow.

Control Room Modernization

The old control rooms contained the original facility benchboards and were not large enough to accommodate both the facility operating staff and the customer aerodynamics staff. Each new control room is at least 1800 square feet, and will accommodate data acquisition and control systems as well as the facility and customer staff during a wind tunnel test. A small instrumentation repair room is also being included in each control room in order to facilitate on site repair of model and data system electronics. Advanced indirect overhead lighting systems have been installed to reduce computer monitor glare.

Performance and Capability

In addition to the above modifications which increase performance, the four main drive motors are being rewound and will increase the power capability, going from 45,000 horsepower to approximately 58,000 horsepower each. The rewinding is being done at Westinghouse facilities. Each motor was removed from the

View looking upstream at 11x11-foot Wide Angle Diffuser (WAD) adjustable turning vanes. (Frank Kmak, Aero/Operations Manager for the Unitary Project, in foreground.)

Unitary Modernization

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motor house by means of two large capacity mobile cranes. The process of rewinding the motors has been a challenge at times, causing some modest delays in the project. However, workable solutions have been found which are currently being implemented. The rewind motors are due to be delivered in September '97.

New composite fan blades will be delivered in September '97, replacing the old machined aluminum blades in the three-stage compressor which drives the 11-by 11-foot leg. The old blades required extensive on-going preventative maintenance, and decreased the productive testing time in the tunnel due to restrictive operational speed ranges. The new composite blades have been designed to operate anywhere in the operational range of the 11-by 11-foot tunnel.

New cooling coils are being installed in the common leg which supports the two Supersonic tunnels. This will increase cooling capability and therefore increase Reynolds number capability.

A new high-capacity turntable in the 11-by 11-foot test section increases the facility's capability, since it allows testing of larger semi-span models.

Increased Reliability

Many components of the UPWT have been completely redone or refurbished, in addition to those listed above. The maintenance work on the MUA (Make-up Air) motor will extend its service life for twenty additional years. The MUA piping has been replaced, and the cooling water distribution piping was repaired and relined. The old redwood cooling tower was torn down and a modern Fiberglass Reinforced Plastic (FRP) tower put in its place. The twenty-year old Main Drive Speed Controller was replaced with a programmable microprocessor-based control system. The electrical system has been improved, with upgraded circuit breakers and transformers.



Removal of one of the four 120 ton main drive motor units, prior to being rewound at a Westinghouse facility.

Testing Schedule

The UPWT project recently energized the facility, and the subsystem checkout phase has begun. At the completion of the subsystem tests and Combined System Tests (CST), the Auxiliaries Make-Up Air IST (Integrated System Test) will begin in December of 1997. The 11-by 11-foot IST is scheduled to begin January '98. "Now that testing has begun, the Project is looking forward to placing the Unitary facility back into operation", states Dan Bufton, Unitary Modernization Project Manager.

Modernization Project Web Site

For more background information on the scope of the project, access the web site at <http://fragment.arc.nasa.gov/unitary/index.htm>. The web pages for this project outline the objectives, give extensive history of the wind tunnel, and display a number of photographs, including an overhead picture of the Unitary Wind Tunnel, with its different components labeled for easy identification. ❖

ASTOVL Lift Fan Simulation

By Ron Gerdes and Girish Chachad

A piloted simulation of an Advanced Short Take Off and Vertical Landing (ASTOVL) Lift Fan aircraft, conducted on the Vertical Motion Simulator (VMS), was successfully completed on April 18th. The simulated aircraft was a 'Harrier-like' strike fighter with a propulsion system consisting of a turbofan lift-cruise engine equipped with a 2-dimensional cruise nozzle in addition to vectorable lift nozzles and a shaft-driven lift fan for low speed and hover flight.

This experiment investigated control mode integration and head up display (HUD) conformality over a range of STOVL aircraft operations applicable to that of the Joint Strike Fighter (JSF). Ames was joined by engineers and pilots from the U.S. Marine Corps and Navy, the United Kingdom Defense Research Agency, and Boeing and Lockheed Martin, the two contractors competing in the JSF program.

The specific objectives for the experiment were as follows:

1. Evaluate the integration of the throttle-type controller with flight control laws that provide for controllability during transition from cruising flight to hover.
2. Evaluate control mode blending for pitch, roll, yaw, and flightpath control during transition.
3. Evaluate the effect of conformal vs. non-conformal HUD presentation of flightpath and guidance symbology.
4. Demonstrate advanced control and display systems for STOVL operations to visiting JSF program pilots and engineers.

The demonstrations for the JSF visitors were performed to give them a view of alternative control design concepts and how they function for all aspects of STOVL operations, land based and aboard ship. The simulation allowed all involved to experience short and vertical takeoffs, transition to and from cruise flight, approach to landing, precision hover, and vertical and slow



**ASTOVL
aircraft
getting
ready to
land on
LPH
assault
ship.**

landings. They were able to see how the various control modes blended from one flight phase to another, and the interface of the pilot controls and cockpit displays with these modes.

The government and industry participants in this simulation were particularly appreciative of the opportunity to obtain design results for the JSF program first hand. The group went away with a number of applications to the design of their flight control systems and cockpit interface. They also recognize the unique capability of the VMS facility for evaluation of their own STOVL aircraft designs. ❖



ISO: One Year to

Certification

by Sally Brew

The title of this column has been changed from Continuous Improvement to ISO to reflect the changes in the division over the last year. AO, a center leader in continuous improvement, recognized that ISO was a means to provide a solid foundation for improvement. Thus AO has become the trailblazer at the center, establishing ISO as a standard of quality which will result in continuous improvement in the work we do.

With the goal of ISO certification a year away, ISO implementation remains on schedule under the leadership of Ron Johnson, AO's Management Representative. The focus now is on writing and updating documentation of AO procedures, training an internal audit team, and selection of a registrar for certification. About forty-five documents, ranging from 3 pages to manuals, have been identified as covering AO's implementing procedures.

A number of elements apply to all employees. Two examples are 4.18, Training, and 4.20,

TTCP2 VMS Simulation

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3. Pilot receives the alarm every 5 or 10 minutes

The last test condition most closely resembles actual flying conditions, where the interval between alerts may be measured in hours.

When the pilot was receiving alarms frequently, either the 'ambient' (wide area flash) or the 'focal' (single character flash) worked well. In test conditions one and two,

where alarms are *frequent*, the pilot is expecting a flash and looking for the alarm. In this situation the pilot doesn't have time to become involved in, and distracted by, another activity. When alarms are *infrequent*, the ambient alarm works better at getting the pilot's attention. The low alert frequency stresses the pilot's vigilance in a realistic way, resulting in occasional missing of alerts. This tendency to fail to make a timely alert response was eliminated by the ambient alert presentation. According to Joe De Maio, the research analyst for this test, "The more of the retina we stimulate, the more effective the alert becomes."

ISO (continued from page 4)

Statistical Techniques. The element of Training basically requires documentation to demonstrate that those employees whose work directly affects the quality of AO's data are qualified to perform their assigned tasks. Three procedures need to be in place to meet the training requirement: (1) a means to identify training needs; (2) generic job descriptions for each position that affects data quality; (3) specific training record for each employee whose work affects AO's product of data. In AO this means that each contractor site manager and branch chief has the responsibility to ensure these documents are in place and training records are maintained for employees under their jurisdiction. An auditor will ask the branch chief or site manager to see these training records.

Another element which is applicable to all employees is 4.20, Statistical Techniques. The requirement of 4.20 is to review processes for possible applications of statistical techniques. These techniques assure that equipment and processes have the capability needed to provide a quality result repeatedly and reliably. Selection and implementation of these techniques are the responsibility of the process owner who is the person who defines how a particular task is to be done.

Examples of work where statistical techniques might benefit would include testing for repeatability or reliability of measurements. Other examples would be for wind tunnel productivity where metrics including downtime are maintained on a daily basis. A third example might be in acceptance testing—assuring that a new capability performs as desired over many trials or test conditions.

An AO Metrics Committee which has worked on ISO implementation will continue to be available to support statistical techniques used within the division. Individuals interested in finding out more about measurements, analysis, and statistical techniques in their area of responsibility can contact Bob Shipley, chairman of the Metrics Committee.

Training and Statistical Techniques are just two of a number of elements which all employees should know and follow. The draft AO Quality Manual, on the AO Server, is available to all employees for review of procedures. As the internal audit team is trained and begins internal audits within a few months, all employees will have a role in understanding and implementing the AO quality system.

The question is, will **you** be ready?❖

"The more of the retina we stimulate, the more effective the alarm ..."

The second objective of this simulation was to test two helmet-integrated navigational displays: a 'CDI' (Course Deviation Indicator) display, similar to an analog compass, and a 'lollipop' display. The latter consists of an arrow on a stick that marks a navigation waypoint, and points the direction to the next waypoint. Pilots were able to use both of these reasonably well until they got off-track. At that point without the 'moving map' traditional display they became disoriented. The challenge for researchers is to extract the most usable, important information from the map data base and present that information in a helmet display. The constraint is size, since the displayed information cannot obscure the out-the-window scene.

Information collected from the simulation includes:

- Time data on how long it takes the pilot to respond to an alert and carry out a specified procedure
- Data on navigational accuracy using the CDI and lollipop displays
- Data from measurements that focused on the pilot's situation awareness and response to other information in the environment
- Information from questionnaires completed by pilots post-simulation

The data accumulated from these runs met the researcher's needs, and preliminary analysis has begun. De Maio states, "The effects we were hoping to see are showing up." A follow-up study is planned here in '98.❖

Contractor Employee of the Month for March - Dan Loney

Dan Loney (CALSPAN) did an outstanding job as the instrument engineer for the 4% HSCT Arrow Wing Test in the 12 Foot PWT, which was completed in March. When the model arrived it required extensive machine work, and Dan had to work around access conflicts with the machine



Dan Loney

shop. Dan was able to keep up with the schedule despite very limited resources and limited access to the model. He also assisted the Boeing engineers, using his personal video camera to digitize pictures of the test section, which he sent to them via the Internet. This helped them with their setup and installation.

After a thorough checkout in the model prep room, there was a major problem with electrical noise contaminating the balance signals. Although this was unexpected, Dan made a Herculean effort to troubleshoot and correct the problem. Through his technical leadership, and working long hours with the technician staff, improvements in the cabling and shielding reduced the noise by 50% to an acceptable level. He was also instrumental in getting noise experts from the CKC Laboratories Inc. to perform a noise survey. The importance of doing this cannot be overstated - having a disinterested third party determine the noise source makes committing the funds and other resources to correct the problem much easier.

Dan Loney is to be commended for his proactive approach to getting the model and the control room ready for the test, and the technical competence that he exhibited while under intense pressure.❖

Civil Service Employee of the Month for March - Pete Zell

On his own initiative, Pete has completely changed and revitalized the wall displays in the hallway of N221. Using model photos, crew photos, articles and original art, Pete has created an informative and entertaining collage of past, present and future activities at the NFAC. Subjects such as What's New, Frequently Asked Questions, NFAC Schedule and Status and Employee Information are presented in a manner that invites the staff to stop and read the material. At a time when the NFAC facility is not operational, Pete's efforts have helped to keep the staff informed and interested.❖



Pete Zell

Retirement Barbecue for Roy Presley

Place: Chase Park, Moffett Field
Date/Time: June 25th, 11:30 am
Price: \$10/Person
Contact: Maureen Weller (4-5853)
or Pat Crooks (4-5882)



On Wednesday, June 25, 1997, a farewell barbecue will be held to honor Roy Presley on the occasion of his retirement from Ames Research Center. All of his friends are invited to attend. (Please make your reservation by June 19th!)

Civil Service Employee of the Month for February - Herb Moss

Herb Moss (photo not available) has been named Civil Service Employee of the Month for February, for his proactive approach in developing the maintenance manual. This manual defines the process for doing maintenance in the wind tunnels. The manual will assist everyone in knowing and understanding the process for accomplishing the work which will save division resources in the future. He has also conducted training classes on this process. Herb has been a champion for maintenance, and organized the Ames Maintenance Team (AMT) with representatives from Codes A, S, and J to share experiences and equipment. This team meets weekly to address issues and to share experiences. They also participate in a monthly video conference with the other centers and headquarters on these issues.❖

New Employee Announcement

**Welcome
to Herb
Finger,
New AOI
Branch
Chief!**



Contractor Team of the Month for March - Dave Carothers, Gloria Lane, Chris Sweeney, and Cary Wales

Dave Carothers, Gloria Lane, Chris Sweeney and Cary Wales (SYRE) have received this award for their support of the Israeli CH-53D accident scenario simulation earlier this year.

The Simlab was requested to assist the accident investigation team after two CH-53D helicopters collided in Israel this February (see article in April issue of AO Connections.) The request for help was on very short notice. Knowing that there was very little time to bring up the simulation, Chris Sweeney, who led the effort, worked long hours, mostly on second shift, to prepare the CH-53 helicopter math model and get it into shape for the simulation.



Chris Sweeney, Gloria Lane and Cary Wales (Dave Carothers not available for photo)

The accident investigation team members arrived on March 10th with a radar map of the positions of the two helicopters and eyewitness testimony. With Gloria Lane's help, the radar map was placed on a digitizing tablet and the position of all the points were recorded into a file. Shortly after the investigation team's arrival, the database modelers were requested to make the CH-53 more representative of the actual Israeli aircraft. Dave Carothers, Gloria Lane, and Cary Wales worked very hard and did an outstanding job assisting the investigation team. Sixty different runs of various viewing angles of the collision were collected onto video. The investigation team members left March 13th pleased with the data and videos, and with a better understanding of the flight paths and time/space relationship of the two helicopters.

Civil Service Employee of the Month for April - Cash Best

In September of 1996, Cash Best became the lead mechanic at the High Reynolds Channel (HRC) facilities. Cash took it upon himself to ensure that the researchers and engineers using the HRCs had the mechanical support that they needed. He is credited for putting the HRC-I back together for a recent AST (Advanced Subsonic Technology) test. In addition to his regular, full-time HRC-II operational duties, he installed the HRC-I test section, pipe fit and hydrotested the auxiliary air supply, and directed the implementation of safety features for the auxiliary air supply. His dedicated efforts saved the government \$7500.

Cash recommended and implemented a change to the feed line used to set the dome pressure on the auxiliary air regulator, and also suggested and implemented modifications to the auxiliary air interlock system that would allow operation of the air system with the tunnel isolation valves open. Both of these suggestions significantly improved the safety of the auxiliary air system. Thanks in large part to Cash, the HRC-I is back in operation and is currently running the AST test on schedule.



Cash Best

Contractor Team of the Month for April - Debbie Ballinger and Sally Brew

The AO Division ISO 9000 certification process achieved a significant milestone in April, with the completion of the Quality Manual (QM). Tailoring a meaningful QM was a difficult task, due to the wide variety of processes within the Division, cutting across numerous branches and contractors. In addition, there are many general requirements in the ISO standard that are subject to interpretation. Debbie Ballinger of SYRE and Sally Brew of CALSPAN were instrumental in the development of the QM. Each made important contributions to the ongoing ISO development of the QM in every area, including the definition of relevant processes, the identification and documentation of the QM sections, the negotiation with branch managers in resolving intra- and inter-branch issues, the review and edit of multiple document drafts, and the presentation of the QM outline to management. They have demonstrated outstanding initiative, enthusiasm and persistence. Their work was essential to the completion of the Quality Manual, and laid the foundation for the subsequent lower-level document implementation phase, now underway.❖



Sally Brew and Debbie Ballinger



Ames Aero Days!!!

A new NASA educational experience!

An opportunity for children and parents to explore, play with, and provide feedback on the educational CD-ROM 'Exploring Aeronautics' produced right here at Ames!! There will be a brief (10 minute max) introduction to the CD and the review process, then all the time you want to explore the CD within the session time! (Feedback forms can be filled out 'as you go' or at session end.)

Who: Adults and kids grades 4-6 (includes children entering 4th in fall of '97 and those leaving 6th this June.) **Note:** at least one adult in a group must be an employee of Ames or an Ames Contractor; kids are optional, adults are not.)

Where: Teacher Training Facility - Building N226

When: Friday, June 20 and Saturday, June 21
There will be 4 sessions offered -
you only need to attend one session!

Friday AM	9:00 - 11:30
Friday PM	1:00 - 3:30
Saturday AM	9:00 - 11:30
Saturday PM	1:00 - 3:30



How: Please fill out the registration form. Registration forms are available in AOGROUPS on the A04/N227 Server. (If you need real paper call (4-3867) or e-mail lalderete.)
Return Registration Form either by e-mail (lalderete) or fax (4-3869).
Please submit a form even if you have already indicated you are interested in attending!

News from the Education Front - Part Trois

by Liza Alderete

The 'Exploring Aeronautics' CD is really looking great! We're coming down to the wire on the beta version and it is really starting to take shape! Don't forget to sign up for Aero Days on June 20 and 21 (described above). My completely unbiased opinion is that you and your kids will have a great time! After all, how often do you get to spend time with your kids showing them the wonders of NASA, sneaking in something educational on them, and getting free home-baked goodies to boot. Such a deal! Please send your forms in by early June so we can bake enough cookies!

Aero Days is just the beginning of the summer activities in the education world. The day after Aero Days, 25 teachers will be arriving from rural and Native American schools in Arizona, Maine, Kansas, and the Dakotas for a week-long introduction to NASA science and dealing with access and issues of integrating culture into science teaching.

At the end of July, we will be hosting the Presidents of the 29 Native American Tribal Colleges for their summer retreat. The title of the retreat is "Bridging the World of Culture and Tradition with Science and Technology". We are working with several of the high tech companies including Intel, Netscape, Cisco, IBM and others to forge partnerships between the high tech industry and the tribal colleges. Tours of Ames as well as the high tech companies will be included in the agenda.

Well, that's about all for now! Don't forget to sign up for Aero Days!❖

AO CONNECTIONS ***helping you get to know AO!***

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